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Survey of Reader Preferences Concerning the Format of NASA Langley-Authored Technical Reports

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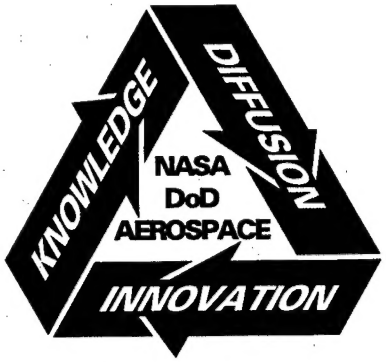

National Aeronautics and Space Administration

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SURVEY OF READER PREFERENCES CONCERNING THE FORMAT OF NASA LANGLEY-AUTHORED TECHNICAL REPORTS

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ABSTRACT

The U.S. government technical report is a primary means by which the results of federally funded research and development (R&D) are transferred to the U.S. aerospace industry. However, little is known about this information product in terms of its actual use, importance, and value in the transfer of federally funded R&D. Little is also known about the intermediary-based system that is used to transfer the results of federally funded R&D to the U.S. aerospace industry. To help establish a body of knowledge, the U.S. government technical report is being investigated as part of the *NASA/DoD Aerospace Knowledge Diffusion Research Project.* In this paper, we summarize the literature on the U.S. government technical report and present the results of a survey of U.S. aerospace engineers and scientists that solicited their opinions concerning the format of NASA Langley Research Center (LaRC)-authored technical reports. To learn more about the preferences of U.S. aerospace engineers and scientists concerning the format of NASA LaRC-authored technical reports, we surveyed 133 report producers (i.e., authors) and 137 report users in March-April 1996. Questions covered such topics as (a) the order in which report components are read, (b) components used to determine if a report would be read, (c) those components that could be deleted, (d) the placement of such components as the symbols list, (e) the de-sirability of a table of contents, (f) the format of reference citations, (g) column layout and right margin treatment, and (h) and person and voice. Mail (self-reported) surveys were used to collect the data. The response rates for report producers (i.e., authors) was 68% and for users was 62%.

INTRODUCTION

NASA and the DoD maintain scientific and technical information (STI) systems for acquiring, processing, announcing, publishing, and transferring the results of government-performed and government-sponsored research. Within both the NASA and DoD STI systems, the U.S. government technical report is considered a primary mechanism for transferring the results of this research to the U.S. aerospace community. However, McClure (1988) concludes that we actually know little about the role, importance, and impact of the technical report in the transfer of federally funded R&D because little empirical information about this product is available.

We are examining the system(s) used to diffuse the results of federally funded aerospace R&D as part of the *NASA/DoD Aerospace Knowledge Diffusion Research Project.* This project investigates, among other things, the information-seeking behavior of U.S. aerospace engineers and scientists, the factors that influence the use of scientific and technical information (STI), and the role played by U.S. government technical reports in the diffusion of federally funded aerospace STI (Pinelli, Kennedy, and Barclay, 1991; Pinelli, Kennedy, Barclay, and White, 1991). The results of this investigation could (a) advance the development of practical theory, (b) contribute to the design and development of aerospace information systems, and (c) have practical implications for transferring the results of federally funded aerospace R&D to the U.S. aerospace community.

In this paper, we summarize the literature on technical reports and present the results of a survey of U.S. aerospace engineers and scientists that solicited their opinions concerning the format of NASA Langley Research Center (LaRC)-authored technical reports, we surveyed 133 report producers (i.e., authors) and 137 report users. Mail (self-reported) surveys were used to collect the data. The response rates for report producers (i.e., authors) was 68% and for users was 62%.

THE U.S. GOVERNMENT TECHNICAL REPORT

Although they have the potential for increasing technological innovation, productivity, and economic competitiveness, U.S. government technical reports may not be utilized because of limitations in the existing transfer mechanism. According to Ballard, et al., (1986), the current system "virtually guarantees that much of the Federal investment in creating scientific and technical information (STI) will not be paid back in terms of tangible products and innovations." They further state that "a more active and coordinated role in STI transfer is needed at the Federal level if technical reports are to be better utilized."

Characteristics of Technical Reports

The definition of the technical report varies because the report serves different roles in communication within and between organizations. The technical report has been defined etymologically, according to report content and method (U.S. Department of Defense, 1964); behaviorally, according to the influence on the reader (Ronco, et al., 1964); and rhetorically, according to the function of the report within a system for communicating STI (Mathes and Stevenson, 1976). The boundaries of technical report literature are difficult to establish because of wide variations in the content, purpose, and audience being addressed. The nature of the report—whether it is informative, analytical, or assertive—contributes to the difficulty.

Fry (1953) points out that technical reports are heterogenous, appearing in many shapes, sizes, layouts, and bindings. According to Smith (1981), "Their formats vary; they might be brief (two pages) or lengthy (500 pages). They appear as microfiche, computer printouts or vugraphs, and often they are loose leaf (with periodic changes that need to be inserted) or have a paper cover, and often contain foldouts. They slump on the shelf, their staples or prong fasteners snag other documents on the shelf, and they are not neat."

Technical reports may exhibit some or all of the following characteristics (Gibb and Phillips, 1979; Subramanyam, 1981):

- Publication is not through the publishing trade.
- Readership/audience is usually limited.
- Distribution may be limited or restricted.

- Content may include statistical data, catalogs, directions, design criteria, conference papers and proceedings, literature reviews, or bibliographies.

- Publication may involve a variety of printing and binding methods.

The SATCOM report (National Academy of Sciences—National Academy of Engineering, 1969) lists the following characteristics of the technical report:

- It is written for an individual or organization that has the right to require such reports.

- It is basically a stewardship report to some agency that has funded the research being reported.

- It permits prompt dissemination of data results on a typically flexible distribution basis.

- It can convey the total research story, including exhaustive exposition, detailed tables, ample illustrations, and full discussion of unsuccessful approaches.

History and Growth of the U.S. Government Technical Report

The development of the [U.S. government] technical report as a major means of communicating the results of R&D, according to Godfrey and Redman (1973), dates back to 1941 and the establishment of the U.S. Office of Scientific Research and Development (OSRD). Further, the growth of the U.S. government technical report coincides with the expanding role of the Federal government in science and technology during the post World War II era. However, U.S. government technical reports have existed for several decades. The Bureau of Mines *Reports of Investigation* (Redman, 1965/66), the *Professional Papers of the United States Geological Survey*, and the *Technological Papers of the National Bureau of Standards* (Auger, 1975) are early examples of U.S. government technical reports. Perhaps the first U.S. government publications officially created to document the results of federally funded (U.S.) R&D were the technical reports first published by the National Advisory Committee for Aeronautics (NACA) in 1917.

Auger (1975) states that "the history of technical report literature in the U.S. coincides almost entirely with the development of aeronautics, the aviation industry, and the creation of the NACA, which issued its first report in 1917." In her study, *Information Transfer in Engineering*, Shuchman (1981) reports that 75% of the engineers she surveyed used technical reports; that technical reports were important to engineers doing applied work; and that aerospace engineers, more than any other group of engineers, referred to technical reports. However, in many of these studies, including Shuchman's, it is often unclear whether U.S. government technical reports, non-U.S. government technical reports, or both are included (Pinelli, 1991).

The U.S. government technical report is a primary means by which the results of federally funded R&D are made available to the scientific community and are added to the literature of

science and technology (President's Special Assistant for Science and Technology, 1962). McClure (1988) points out that "although the [U.S.] government technical report has been variously reviewed, compared, and contrasted, there is no real knowledge base regarding the role, production, use, and importance [of this information product] in terms of accomplishing this task." Our analysis of the literature supports the following conclusions reached by McClure:

- The body of available knowledge is simply inadequate and noncomparable to determine the role that the U.S. government technical report plays in transferring the results of federally funded R&D.

- Further, most of the available knowledge is largely anecdotal, limited in scope and dated, and unfocused in the sense that it lacks a conceptual framework.

- The available knowledge does not lend itself to developing "normalized" answers to questions regarding U.S. government technical reports.

BACKGROUND

This research replicates, in large part, an earlier study that examined the preferences of readers concerning the format of NASA-authored technical reports The 1981 study included a survey of engineers and scientists at the NASA LaRC and in academia and industry. The study was conducted to determine the opinions of readers concerning the format (organization) of NASA technical reports and usage of technical report components. A survey questionnaire was sent to 513 LaRC engineers and scientists and 600 engineers and scientists from three professional/technical societies. The response rates were 74% and 85%, respectively (Glassman and Cordle, 1982). The questionnaire contained 14 questions covering 12 survey topics which included the order in which users read report components, the components reviewed or read to determine whether to read a report, report components which could be deleted, the desirability of a table of contents, the desirability of both a summary and abstract, the location of the symbols list and glossary, the integration of illustrative material, the preferred format for reference citations, column layout and right margin treatment, and person/voice.

Conclusions were drawn from the 14 questions which were grouped into 12 survey topics. The results of the reader preference survey indicated that the conclusion was the component most often read by survey respondents. The summary, conclusion, abstract, title page, and introduction were the components used most frequently to determine if a report would actually be read. Participants in the 1981 study indicated that the summary as well as the abstract should be included, that the definition of symbols and glossary of terms should be located in the front of the report, and that illustrative material should be integrated with the text rather than grouped at the end of the report. Citation by number was the preferred format for references. A one-column, ragged right margin was preferred. Third person, passive voice was the style of writing preferred by the respondents.

METHODOLOGY

This research is a Phase 1 activity of the *NASA/DoD Aerospace Knowledge Diffusion Research Project.* Survey participants consisted of NASA LaRC report producers (i.e., authors) and report users (i.e., recipients). Report producers were those individuals who had authored a NASA LaRC technical report in 1993 and 1994. Surveys were sent to 192 LaRC authors; 137 usable surveys were received. The response rate for the "internal" participants was 71%. Individuals on the supplemental distribution list NASA LaRC-authored reports formed the report user sample. Surveys were sent to 221 report recipients; 133 usable surveys were received. The response rate for the "external" participants was 60%. The surveys were conducted in March-April 1996 timeframe. The questionnaire used in the 1981 study was modified for use in this research. The instrument used in the 1996 study contained 16 questions concerned with the format of NASA LaRC-authored technical reports. An additional 15 questions, included in the questionnaire, pertained to the technical quality and accuracy of data contained in NASA LaRC-authored technical reports.

The following "composite" participant profile was developed for the *internal* respondents: works in government (100%), has a master's degree (54%), performs duties as a researcher (84.7%), was educated as and works as an engineer (78.1%; 73.7%%), and is a male (83.9%). The following "composite" participant profile was developed for the *external* respondents: works in industry (100%); has a master's degree (41.4%); performs duties in design/ development (27.1%), management/supervision (27%), and research (22.6%); was educated as and works as an engineer (81.2%;75.2%), and is a male (94.7%).

PRESENTATION AND DISCUSSION OF THE RESULTS

Order in Which Users Read or Review Report Components

Survey respondents were asked to use the technical report provided and to number a list of report components to indicate the chronological sequence in which these components are generally read. The question as it appeared in the questionnaire is shown below.

The format for a typical NASA LaRC technical report appears below. Please number IN ORDER, the components you generally read/review. (For example, if you read the "ABSTRACT" first, number it with a "1." Do not number those components you skip.

a.____Title Page
b.____Foreword
c.____Preface
d.____Contents
e.____Summary
f.____Introduction
g.____Symbols List
h.____Glossary of Terms
i.____Description of Research Procedure
j.____Results and Discussion
k.____Conclusions
l.____Appendixes
m.____References
n.____Tables
o.____Figures
p.____Abstract

Table 1 shows, for each component, the percentage of survey respondents who indicated they read that component at some stage in the use sequence. The report components are listed in descending frequency of use. For the *internal* respondents, the components read by the highest percentage of readers were the results and discussion and the conclusions. Other components read by more than 80% of the internal respondents were the introduction, description of the research procedure, and the title page. For the *external* respondents, the components read by the highest percentage of readers were the conclusions and the summary. Other components read by more than 80% of the external respondents were the title page and the abstract. Components read by 80% of both groups were the conclusions (94.7%), results and discussion (87.6%), introduction (83.1%), title page (82.5%), and the summary (82.2%). Conversely, certain components were read by very few respondents in either survey group. The foreword and preface had very low usage rates: *internal* respondents 15.9%/15.2 and *external* respondents 38.9%/32.9%. (With the exception of NASA Special Publications, NASA LaRC technical reports generally do not include a foreword or preface.) Other components read by less than half of both groups include the glossary of terms (29.1%) and the symbols list (37.5%).

To clarify sequence of use of report components, a weighted average ranking was calculated and is presented in Table 2. Weighted average rankings were used to determine the order of use of the 16 report components. The weighted average rankings were obtained by assigning weights based on specific order of use. A weight of 16 was assigned for the component read first, 15 for components read second, decreasing sequentially to 1 for components read sixteenth. The weighted was calculated by the formula

$$\frac{\sum n_i w_i}{n_t}$$

where ni was the number of users reading a component in the "ith" position, w_i was the weight assigned for the "ith" position, and n_t was the total number of users who read that component in any position.

When both groups were combined, the resulting mean sequence for the first six components read was title page, abstract, summary, introduction, conclusions, and table of contents. Examined separately, the internal and external groups showed the exact overall patterns in sequential positions. Although the abstract appears on the last page of a NASA report, this component was read by about 74% of the internal and 82% of the external respondents. Moreover, the abstract was the second report component read by both report producers and users.

Components Reviewed or Read to Determine Whether to Read the Full Report

The respondents were asked to indicate which report components (up to five) were used to decide whether to read the report. Respondents were asked to indicate the order in which these components were read. Table 3 lists the five components most frequently used by survey respondents in reviewing reports for possible reading and the percentage use by each group. Respondents from both groups identified the abstract (71.6%/67.7%) as the component most often reviewed to determine if a report would actually be read. The summary (65.7%) was the component utilized second (most often) by the respondents to the internal respondents as a screen-

Table 1. Percentage of Survey Respondents Who Read Various Langley-Authored Technical Report Components

Internal Survey (n = 137)		External Survey (n = 133)		Combined Surveys (n = 270)	
Component	Percentage who read	Component	Percentage who read	Component	Percentage who read
Title page	81.6	Title page	83.3	Title page	82.5
Abstract	74.3	Abstract	82.0	Abstract	78.2
Introduction	90.3	Introduction	75.8	Introduction	83.1
Table of contents	43.6	Table of contents	59.9	Table of contents	51.8
Conclusions	94.7	Conclusions	94.6	Conclusions	94.7
Foreword	15.9	Foreword	38.9	Foreword	27.4
Results and discussion	95.5	Results and discussion	79.6	Results and discussion	87.6
Description of research procedure	84.5	Description of research procedure	59.3	Description of research procedure	71.9
Preface	15.2	Preface	32.9	Preface	24.1
Figures	79.4	Figures	62.3	Figures	70.9
Symbols list	47.3	Symbols list	27.7	Symbols list	37.5
Glossary of terms	31.9	Glossary of terms	26.2	Glossary of terms	29.1
Tables	63.3	Tables	50.2	Tables	56.8
References	63.3	References	49.5	References	56.4
Appendixes	62.6	Appendixes	39.7	Appendixes	51.2
Summary	79.4	Summary	85.0	Summary	82.2

Table 2. Weighted Average Ranking: Order in Which LaRC-Authored Technical Report Components Are Read

Internal Survey (n = 137)			External Survey (n = 133)			Combined Surveys (n = 270)		
Component	n	Weighted avg. rank*	Component	n	Weighted avg. rank*	Component	n	Weighted avg.rank*
Title page	113	15.8	Title page	112	15.6	Title page	225	15.7
Abstract	103	14.5	Abstract	109	13.9	Summary	223	14.2
Summary	110	13.5	Introduction	102	12.2	Abstract	212	13.5
Introduction	125	12.4	Table of contents	77	10.8	Introduction	227	12.3
Conclusions	131	11.5	Conclusions	127	11.3	Conclusions	258	11.4
Table of contents	61	11.4	Foreword	53	10.5	Table of contents	138	11.1
Description of research procedure	117	10.7	Results and discussion	107	10.6	Foreword	239	10.5
Results and discussion	132	10.4	Description of research procedure	80	10.0	Description of research procedure	197	10.4
Figures	110	10.0	Preface	45	9.4	Figures	194	9.8
Symbols list	66	8.4	Figures	84	9.5	Results and discussion	76	9.7
Tables	88	7.9	Symbols list	38	6.5	Preface	67	8.5
References	88	7.8	Glossary of terms	36	5.6	Tables	156	8.0
Foreword	23	7.8	Tables	68	8.2	Symbols list	104	7.6
Appendixes	45	6.6	References	67	6.6	Glossary of terms	155	7.3
Glossary of terms	88	6.5	Appendixes	54	6.0	References	141	6.7
Preface	22	6.5	Summary	113	13.5	Appendixes	81	6.1

*Highest number indicates component was read first; lowest number indicates component was read last.

ing tool. The conclusions (57.9%) was the component utilized second (most often) by the respondents to the external respondents as a screening tool. *Internal* respondents indicated the summary, title page, conclusions, and introduction (listed decreasing frequency of use) as the components most often reviewed to determine if a report would actually be read. *External* respondents indicated the conclusions, title page, summary, and introduction (listed decreasing frequency of use) as the components most often reviewed to determine if a report would actually be read.

Table 3. Components Most Commonly Used to Review/Read LaRC-Authored Technical Reports

Component	Percentage of respondents indicating use of a report component	
	Internal Survey n = 137	External Survey n = 133
Abstract	71.6	67.7
Summary	65.7	47.7
Title Page	57.7	57.2
Conclusions	54.9	57.9
Introduction	36.7	34.0

Table 4 gives a weighted average ranking for order of use of the five components most frequently reviewed in deciding whether to read a report. This table shows that the most common sequence used by combined surveys was: title page, abstract, summary, introduction, and conclusions. The use pattern for both internal and external groups was the same as that for the combined surveys (i.e., both producers and users).

Table 4. Weighted Average Ranking: Order in Which Components Are Reviewed in Deciding Whether to Read a LaRC-Authored Technical Report

Internal Survey (n = 137)			External Survey (n = 133)			Combined Surveys (n = 270)		
Component	n	Weighted avg. rank*	Component	n	Weighted avg. rank*	Component	n	Weighted avg. rank*
Title page	113	15.8	Title page	112	15.6	Title page	225	15.7
Abstract	103	14.5	Abstract	109	13.9	Abstract	212	14.2
Summary	110	13.5	Summary	113	13.5	Summary	223	13.5
Introduction	125	12.4	Introduction	102	12.2	Introduction	227	12.3
Conclusions	131	11.5	Conclusions	127	11.3	Conclusions	258	11.4

*Highest number indicates component was read first; lowest number indicates component was read last.

Report Components Which Could Be Deleted

Survey respondents were asked to list any NASA Langley-authored report components (up to five) that could be deleted. The most dispensable components were thought to be the foreword and preface by both survey groups. About 70% and 64% of the internal respondents suggested deleting the preface and foreword, respectively. About 39% and 38% of the external respondents suggested the foreword and the preface as components that could be deleted. About 23% of the internal respondents indicated deleting the table of contents. On the other hand, only about 5% of the external respondents suggested that the table of contents could be deleted.

Desirability of a Table of Contents

Survey participants were asked a question concerning the need for and or desirability of a table of contents in NASA Langley-authored technical reports. Summaries of the results from the internal and external respondents are given in Table 5.

Table 5. Opinions of Respondents Concerning the Desirability of a Table of Contents in All LaRC-Authored Technical Reports

	Internal respondents (n = 137)		External respondents (n = 133)	
Response	%	n	%	n
Yes, all should	21.2	29	53.4	75
No, only long reports need it	78.8	108	46.6	58

About 21% of the internal respondents indicated that all NASA Langley-authored technical reports (regardless of length) should contain a table of contents; however, of the external respondents, 53.4% expressed the need for a table of contents in all NASA langley-authored technical reports. Thus, although about 79% of the internal respondents indicated that only long reports need a table of contents, about twice as many (53.4%) external (non-NASA Langley) respondents expressed the desire for this component in all NASA Langley-authored technical reports than did their internal counterparts.

Desirability of a Summary in Addition to an Abstract

Respondents were asked a question concerning the need for a summary (appearing in the front) in addition to the abstract, which appears as back matter on the Report Documentation Page (RDP) of NASA Langley-authored technical reports. Summaries of the results obtained from the internal and external respondents are given in Table 6. Internal respondents were about evenly divided about whether the more detailed summary should be included in NASA Langley-authored technical reports in addition to the abstract. A slight majority (50.4%) favored inclusion

Table 6. Opinions of Respondents Concerning the Desirability of a Summary in Addition to an Abstract in All LaRC-Authored Technical Reports

Response	Internal respondents (n = 137)		External respondents (n = 133)	
	%	n	%	n
Yes, include a summary, too	50.4	69	60.2	80
No, don't bother with it	49.6	68	39.8	53

of both components. Among external respondents, however, 60.2% indicated that NASA Langley-authored technical reports should have a summary in addition to an abstract.

Location of the Definition of Symbols and Glossary of Terms

Survey respondents were asked to indicate where in a NASA Langley-authored technical report the definition of symbols and glossary of terms components should appear. Summaries of the results from the internal and external respondents are given in Tables 7 and 8.

Table 7. Opinions of Respondents Concerning the Location of the Symbols List in LaRC-Authored Technical Reports

Response	Internal respondents (n = 137)		External respondents (n = 133)	
	%	n	%	n
After Contents	10.2	14	25.6	34
After Introduction	39.4	54	10.5	14
As an Appendix	13.9	19	19.5	26
Near front of report AND where symbols appear	15.3	21	20.3	27
Near back of report AND where symbols appear	5.8	8	10.5	14
NO Symbols List needed; just define the symbol where it appears in the report	15.3	21	13.5	18

Concerning the location of the Symbols List, the response patterns from the internal and external respondents were different. The largest percentage of internal (39.4%) and external (25.6%) respondents chose the response, "after Introduction" and "after Contents." The second highest percentages of both groups (15.3%) and (20.3%) chose "near front of report AND where symbols appear." Thus, when results from these two responses were combined, a preference (64.9% for internal respondents and 56.4% for external respondents) was evident for the De-

finition of Terms to be located near the front of the report as opposed to being located as back matter.

Regarding the location of the Glossary of Terms, the response patterns from the internal and external respondents were different. The largest percentage of the internal (46.7%) respondents selected "no glossary of terms needed; just define the term where it appears in the report." The largest percentage of external respondents (30.8%) chose the response, "as an Appendix." The second highest percentage (24.8%) of the internal respondents and external respondents (15%) chose "after Contents." Thus, when results from these two responses were combined, a preference (32.1% for internal respondents and 43.6% for external respondents) was evident for the glossary of terms to be located near the back of the report as opposed to being located as front matter.

Table 8. Opinions of Respondents Concerning the Location of the Glossary of Terms in LaRC-Authored Technical Reports

Response	Internal respondents (n = 137)		External respondents (n = 133)	
	%	n	%	n
After Contents	4.4	6	15.0	20
After Introduction	7.3	10	3.8	5
As an Appendix	24.8	34	30.8	41
Near front of report AND where terms appear	9.5	13	11.3	15
Near back of report AND where terms appear	7.3	10	12.8	17
NO Glossary of Terms needed; just define the term where it appears in the report	46.7	64	26.3	35

When Appendix Material Is Read

Survey respondents were askeda question concerning when they read appendix material—before, with, or after the text. Summaries of the results from the internal and external respondents are given in Table 9. The internal and external responses were very similar. A strong majority (73% internally and about 77% externally) indicated that the appendixes were read after the text. About 25% of the internal respondents and about 23% of the external respondents stated that the appendixes were read with the text. About 2% of the internal and 0.0% of the external respondents indicated that the appendix material was read prior to reading the text.

Location and Use of Illustrative Material

Internal and external respondents were asked three questions concerning the location and use of illustrative material (such as tables, graphs, and photographs) in NASA Langley-authored tech-

nical reports. A summary of the results from the internal and external respondents is presented in Tables 10, 11, 12, and 13.

Table 9. When Respondents Usually Read Appendix Material in LaRC-Authored Technical Reports

Response	Internal respondents (n = 137)		External respondents (n = 133)	
	%	n	%	n
Before the text	2.2	3	0.0	0
With the text	24.8	34	23.3	31
After the text	73.0	100	76.7	102

About 47% of the internal and about 36% of the external respondents indicated that a list of figures or tables should ONLY be included in NASA Langley-authored technical reports when there is a lot of illustrative material (e.g., over 10 figures, photos, or tables). About 34% of the internal respondents and about 29% of the external respondents reported that "No List of Figures and Tables Needed" in NASA Langley-authored technical reports. About 22% of external respondents indicated that NASA Langley-authored technical reports should always contain a list of figures or tables whenever a report contains illustrative material.

Table 10. Opinions of Respondents Concerning the Need for a List of Figures or Tables in LaRC-Authored Technical Reports

Response	Internal respondents (n = 137)		External respondents (n = 133)	
	%	n	%	n
Only when illustrative material is integrated with the text	4.4	6	6.8	9
Only when illustrative material is separate from the text; at the end of the report	5.8	8	6.0	8
Only when there is a lot of illustrative material (e.g., over 10 figures, photos or tables)	47.4	65	36.1	48
Always; whenever a report contains illustrative material	8.0	11	21.8	29
No List of Figures and Tables needed	34.3	47	29.3	39

Internal and external respondents were asked about the integration of illustrative material as opposed to group it at the end of the report (Table 11). The survey results show that about 77%

of the internal and about 80% of the external respondents preferred that the illustrative material be integrated with the text as opposed to being grouped in the back matter.

Table 11. Opinions of Respondents Concerning Integration of Illustrative Material as Opposed to Grouping It At the End of NASA LaRC-Authored Technical Reports

Response	Internal respondents (n = 137)		External respondents (n = 133)	
	%	n	%	n
Integrated with text	77.4	106	79.7	106
Separate from text; at end of report	22.6	31	20.3	27

Table 12 contains the responses to the third question concerning the placement of illustrative material. About 31% of the internal and about 50% of the external respondents indicated that integration of tables and figures did not interrupt their reading no matter how much illustrative material the report contained. The illustrative-page/text-page ratio which interrupted reading was placed at two by about 49% of the internal respondents and about 35% of the external respondents; at three by about 14% of internal and 9% of external respondents; and at four or more by about 6% of internal and 6% of external respondents.

Table 12. Opinions of Respondents Concerning the Amount of Illustrative Material That Can be Integrated with the Text of LaRC-Authored Technical Reports Without Interrupting the Reader

Response	Internal respondents (n = 137)		External respondents (n = 133)	
	%	n	%	n
Yes, when there are two pages of illustrative material for every page of text	48.9	67	35.3	47
Yes, when there are three pages of illustrative material for every page of text	13.9	19	9.0	12
Yes, when there are four or more pages of illustrative material for every page of text	5.8	8	6.0	8
No, I always prefer to have illustrative material integrated in text	31.4	43	49.6	66

Finally, respondents were asked when they read the illustrative included in NASA Langley-authored technical reports. Summaries of the internal and external responses are presented in Table 13.

Table 13. When Respondents Usually Read Illustrative Material in LaRC-Authored Technical Reports

Response	Internal respondents (n = 137)		External respondents (n = 133)	
	%	n	%	n
Before the text	16.8	23	18.0	24
With the text	80.3	110	79.7	106
After the text	2.9	4	2.3	3

Most respondents (80.3% internally; 79.7% externally) indicated that the illustrative material was read with the text. Some respondents (16.% internally and 18% externally) indicated that the illustrative material was read before the text. Only a few respondents (4% internally and 2.3% externally) indicated that the illustrative material was read after the text.

Format of Reference Citations

Survey respondents were asked to specify their preference between three formats for reference citations in NASA Langley-authored technical reports. Summaries of the internal and external respondents' responses are presented in Table 14.

Table 14. Preferences of Respondents Concerning the Format of Reference Citations Used in LaRC-Authored Technical Reports

Response	Internal respondents (n = 137)		External respondents (n = 133)	
	%	n	%	n
Cited in text by author/year (e.g., Jones 1978) but with an alphabetic list in back of report	27.7	38	27.8	37
Cited in text by number (e.g., reference 16) with a numbered list in back of report	52.6	72	55.6	74
Cited in text by footnote (e.g., Jones[12]) with a numbered list in back of report	19.7	27	16.5	22

About 53% of the internal respondents and about 56% of the external respondents preferred references in the text to be cited by number (e.g., reference 16) with a numbered list in back of report. About 28% of the internal respondents and about 28% of the external respondents preferred references cited in text by author/year (e.g., Jones 1978) but with an alphabetic list in back of report. About 20% of the internal respondents and about 17% of the external respondents preferred references cited in text by footnote (e.g., Jones[12]) with a numbered list in back of report.

Specifications of Units for Dimensional Values

Respondents were asked to specify their preferences regarding the use of the International System (S.I.) units and U.S. Customary units for dimensional values in NASA Langley-authored technical reports. Table 15 contains the results of the survey responses concerning this question.

Table 15. Preferences of Respondents Concerning Units for Dimensional Values Specified in LaRC-Authored Technical Reports

Response	Internal respondents (n = 137)		External respondents (n = 133)	
	%	n	%	n
The International System (S.I.) units (e.g., meter, kilogram)	24.1	33	26.3	36
U.S. Customary units (e.g., foot, pound)	38.0	52	22.6	30
S.I. units with U.S. Customary units in parentheses	15.3	21	18.8	25
U.S. Customary units with S.I. units in parentheses	22.6	31	32.3	42

There was no overall agreement among either survey groups as to how dimensional values should be specified in NASA Langley-authored technical reports. Thirty-eight percent of the internal respondents selected U.S. Customary units (e.g., foot, pound) followed by the International Systm (S.I.) units (24.1%), and U.S. Customary units with S.I. units in parentheses (e.g., meter, kilogram) (22.6%). About 32% of the external respondents selected U.S. Customary units with S.I. units in parentheses, followed by the International System (S.I.) units (e.g., meter, kilogram) (26.3%), and U.S. Customary units (e.g., foot, pound) (22.6%).

Column Layout and Right Margin Treatment

Respondents were asked to state their preferences concerning one or two column layouts and ragged or justified right margins. Table 16 summarizes the results of survey respondents.

Table 16. Preferences of Respondents Concerning Column Layout and Right Margin Treatment in LaRC-Authored Technical Reports

Response	Internal respondents (n = 137)		External respondents (n = 133)	
	%	n	%	n
Two columns; justified right margin	40.9	56	24.1	32
Two columns; ragged right margin	8.0	11	6.0	8
One column; justified right margin	12.4	17	33.8	45
One column; ragged right margin	17.5	24	17.3	23
Mixed format; one and two columns intermixed as mathematical material dictates	21.2	29	18.8	25

About 41% of the internal respondents preferred two columns; justified right margin, followed by a mixed format; one and two columns intermixed as mathematical material dictates (21.2%). About 34% of the external respondents preferred one column; justified right margin followed by two columns; justified right margin (24.1%). Overall, a two column format (48.9%) was preferred by internal respondents and a one column format was preferred by external respondents (51.1%). Justified right margins were preferred over ragged right margins by about 53% of the internal respondents and about 63% of the external respondents.

Person and Voice

Survey respondents were asked to specify their preference in regard to person and voice in NASA Langley-authored technical reports. Table 17 summarizes the results of the internal and external respondents.

Table 17. Preferences of Respondents Concerning Person and Voice for LaRC-Authored Technical Reports

Response	Internal respondents (n = 137)		External respondents (n = 133)	
	%	n	%	n
Passive voice, third person	64.2	88	47.4	63
Active voice, third person	14.6	20	17.3	23
Active voice, first person	21.2	29	35.3	47

Among both groups, the passive voice, third person option was chosen most often as the preferred writing style. Among internal respondents, about 64% selected this preference. Among external respondents, about 47% selected this preference. Considering voice alone, internal respondents preferred the passive voice (64%) over the active voice (35%). On the other hand, external respondents preferred the active voice (53%) over the passive voice (47%).

The majority of both internal (78.8%) and external (64.7%) respondents preferred that third person be used rather than first person in NASA Langley-authored technical reports. It should be noted, however, that a higher percentage of external respondents (35.3%) preferred first person than did the internal group (21.2%).

CONCLUSIONS

Order in Which Report Components Are Read or Reviewed

The most common reading sequence for the first five report components was the conclusions, results and discussion, title page, introduction, and summary. These components were read by the highest percentages of both survey groups. Thus, we concluded that these components should appear in every NASA LaRC technical report. It is very important that a conclusion section appear in every report and that it be independent of the rest of the report.

Components Reviewed or Read to Determine Whether to Read the Full Report

The abstract, conclusions, summary, title page, and introduction represent the components reviewed or read to determine whether to read the full report. The abstract, conclusions, and summary are the components used most frequently as screening tools. One or more of these components may be the only components read or reviewed; therefore, it is important that each of these sections be written so that it can be read and understood independent of the rest of the report. Particular attention should be directed toward the abstract and conclusions because they are the components utilized as screening tools by the highest percentage of respondents.

Report Components Which Could Be Deleted

The foreword and preface were identified as the components recommended for deletion. Survey results indicate that these components are read least frequently by report producers and users. Therefore, it may be desirable to delete these components from the NASA LaRC technical report format.

Desirability of a Table of Contents

The table of contents provides an outline of the report's contents in addition to serving a locator function. A strong majority of **producers** indicated that only long reports need a table of contents; however they are the more likely of the two groups to be most familiar with the

report's content. A majority (53.4%) of **users** indicated that only long reports need a table of contents; however, 5.3% of them indicated that the table of contents was a component that could be deleted. Therefore, it might be advantageous to routinely include a table of contents in all reports regardless of length.

Desirability of a Summary in Addition to an Abstract

NOTE: The summary appears as front matter and the abstract appears as back matter in a NASA LaRC technical report. A slight majority (50.4%) of the **producers** and a majority (60.2%) of the **users** indicated the need for a summary in addition to an abstract. The abstract and the summary are used by both groups of respondents as screening tools. Given that the abstract appears in the Report Documentation Page (RDP), the last page in a U.S. government technical report and that the report is accessioned using the abstract, it is desirable to retain both report components.

Location of the Definition of Symbols and Glossary of Terms

A majority of the **producers** and **users** indicated a preference for the Symbols List to appear as front matter. A majority of **producers** and **users** did not indicate a need for symbols to be defined where they appear in the report. The response patterns for the location of the Glossary of Terms were different. About 47% of the **producers** indicated that a Glossary of Terms was **not needed** and about 32% of them indicated that a Glossary of Terms should appear as back matter. About 44% of the **users** indicated that a Glossary of Terms should appear as back matter. Therefore, these components should be present for reference purposes. The most preferable placement for the Symbols List is as front matter and for the Glossary of Terms as back matter.

When Appendix Material Is Read

A strong majority of **producers** and **users** read appendix material after the text rather than before or with the text. Therefore, the present placement of appendix material as back matter is proper.

Location and Use of Illustrative Material

A strong majority of **producers** (80.3%) and **users** (79.7%) indicated that they usually read the illustrative material with the text. A strong majority of **producers** (77.4%) and **users** (79.7%) indicated that illustrative material should be integrated with the text. About 34% of the **producers** indicated that no List of Figures/Tables was needed; about 47% indicated that a "List" was needed **only** when there is a lot (e.g., 10 or more figures/tables) illustrative material. **Users** were divided: about 22% indicated that a "List" is always needed, about 29% indicated that a "List" was not needed, and about 36% indicated that a "List" was needed when there was a lot of illustrative material. Rule of Thumb: (1) integrate illustrative material where possible and (2) include a "List of Figures/Tables" when there is a lot of illustrative material.

Format of Reference Citations

A majority of **producers** (52.6%) and **users** (55.6%) expressed a preference for references to be cited in the text by number (with a numbered list in the back of the report. Therefore, preference should be for citation by number rather than by author/year.

Specification of Units for Dimensional Values

There is no general agreement either among **producers** and **users** concerning units for dimensional values. Nevertheless, U.S. law and practice "within the discipline" should prevail.

Column Layout and Right Margin Treatment

Two column format (48.9%) is preferred by **producers** and a one column format (51.1%) was preferred by **users**. Justified margins are preferred over ragged margins by both **producers** and **users**. Research concerning readability and comprehension relative to number of column and margin treatment should be consulted before a decision is made.

Person and Voice

Producers (64.2%) prefer the passive voice over the active voice. **Users** (52.6%) prefer the active voice. Both **producers** (78.8%) and **users** (64.7%) prefer third person over first person. Active voice is considered by many authorities to be more natural, concise, and direct. No consensus exists among authorities concerning person.

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